

# REMARKS ON THE SPIROCHAETES OCCURRING IN THE FAECES OF DYSENTERIC PATIENTS

BY

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At the commencement of the present year, while performing, in the laboratory of the Liverpool School of Tropical Medicine, routine examinations of the stools of soldiers suffering from dysentery, actively moving spirochaetes were occasionally detected in the fresh preparations. Owing to the ease with which these minute organisms may be overlooked in such preparations, particularly when the examinations have to be conducted with some rapidity and without employing the highest powers of the microscope to any great extent, the percentage of infected cases appeared low. Accordingly, at the suggestion of Professor Stephens, advantage was taken of the plentiful supply of material available, to make a systematic examination of stained preparations of faeces. The results of this investigation and of a comparative study of the faeces of one hundred non-dysenteric patients form the subject of this article.

The presence of spirochaetes in the stools of both sick and healthy persons has been noted on several occasions during recent years. They have been previously observed in the faeces of patients suffering from amoebic dysentery, cholera and sprue, and Le Dantec in 1903 even cited them as the causative organisms in a case of dysentery said to have been developed in France. However, such records are for the most part isolated, and apparently no serious attempt has been made to determine the percentage of infected individuals—either in healthy or diseased people. Certainly J. G. and D. Thomson (1914) examined the dejecta of numerous persons, both normal and diseased, for spirochaetes, and concluded that a certain proportion of the cases were infected with Werner's two species—*S. eurygyrata* and *S. stenogyrata*. Fantham (1915), also, has given a good account of the morphology of spirochaetes

occurring in the faeces of soldiers suffering from dysentery or diarrhoea, but no numerical data, based on stained specimens, have so far been made.

The validity of many of the species of faecal spirochaetes encountered and described by different authors appears doubtful, and, according to Fantham, it is probable that only one species—*S. curygyrata*, Werner—should be recognised.

For the purpose of the present investigation rapidity was an important factor, and the careful fixation and staining necessary for morphological study was not required. After the fresh preparations had been examined for pathogenic protozoa, therefore, the cover-slips were pushed off the slides and the smears thus obtained fixed by heat. They were then stained with Giemsa or gentian violet.

The examinations (under a  $\frac{1}{2}$ -inch objective and No. 2 ocular) were made as thoroughly as possible in spite of the somewhat limited time available, and from twenty to thirty minutes were spent in carefully searching the negative or apparently negative cases. In all, smears from the stools of 554 patients admitted into hospital for dysentery or related diseases were examined, and of these 313, or 56.5 per cent., showed spirochaetes. Whenever possible, additional samples of the faeces of those proving negative on the first examination were procured and examined after an interval of a week or two; as many as four or five examinations of one patient were sometimes made. Unfortunately, however, a comparatively large number of such cases was not available for further observation, and as a relatively high proportion of the 'first examination negatives' which were obtained for subsequent examination proved positive, the percentage given above is certainly too low. The details of the observations made are as follows:—

	Cases	Positive	Negative
Examined once ... ..	289	180	109
Examined twice ... ..	211	115	96
Examined three times ... ..	49	16	33
Examined four times ... ..	4	2	2
Examined five times ... ..	1	—	1
Total ... ..	554	313	241

That the cases examined more than once show a rather lower percentage of positive infections (50·2) is only to be expected, since many of those proving positive as a result of the first examination were not inspected again. Thus of the 265 cases subjected to two or more examinations, only 75 had been previously shown to harbour spirochaetes; but of the remaining 190 no less than 58, or 30·5 per cent., proved positive subsequently. This relatively high proportion is no doubt chiefly due to the entire disappearance at times of the spirochaetes as such from infected stools. To a smaller extent, perhaps, it may be accounted for by the comparative frequency with which scanty infections were encountered and the corresponding increased tendency to incorrect diagnosis;\* particularly would this be so if only young and very small forms were present. If, however, this proportion (30 per cent.) of those negative cases which only received one examination be regarded as what may be termed 'latent positives,' the final percentage of infected cases would be slightly raised. Of the 109 negative cases referred to in the above table, therefore, about thirty-three should ultimately prove infected, and the total number of positive cases (313) should accordingly be raised to 346 and the percentages from 56·5 to 62·4.

With a view to obtaining, if possible, some evidence regarding the pathogenicity of these organisms, or at least of determining whether disorders of the alimentary canal, induced by pathogenic amoebae, favoured their existence, an examination of the faeces of a number of patients free from such parasites was undertaken.† Stained preparations were made of the stools of 100 cases contained in the Royal Infirmary, Liverpool. These men were suffering from a variety of affections, e.g., rheumatism, hernia, paralysis, bronchitis, pleurisy, neurasthenia, cardiac affections, wounds, gun-deafness, etc., etc. The following is an analysis of the examinations made:—

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\* In this connection it may be remarked that, although no attempt was made to determine the relative densities of the various infections, only sixty-eight of the total positive cases found (which, including those of the non-dysenterics, numbered 354) were marked as possessing heavy or moderately heavy infections.

† The stools of these patients had been previously examined for *Entamoeba histolytica* and were selected because of their entire freedom from this parasite.

	Cases	Positive	Negative
Examined once ... ..	81	33	48
Examined twice ... ..	17	7	10
Examined three times ... ..	2	1	1
Total ... ..	100	41	59

Forty-one per cent. of the cases were thus directly shown to be infected with spirochaetes. It was not possible to obtain samples of the stools of the great majority of these patients more than once, and therefore an appreciable number of 'latent positives' was probably included among the 'negatives.' Owing to this difficulty and to the comparatively small number of cases involved in the investigation, no closer estimate of the ultimate findings can be suggested. It may be pointed out, however, that of the nineteen cases whose faeces were procured for further examination, fourteen were at first declared negative, on subsequent examination three of these showed spirochaetes.

In view of these results, it would seem that spirochaetal infections of the alimentary canal are almost, if not quite, as prevalent in non-dysenteric as in dysenteric patients. The difference indicated between the proportions of infected cases in the respective classes is not so great as to allow the inference that conditions more favourable to the existence and development of these organisms occur when certain pathological aspects of the gut are present. In fact, two of the heaviest and seemingly most persistent infections noted throughout the whole investigation were found among the non-dysenteric cases; one of these patients was under treatment for ear and throat affections and the other for rectal abscess.

Fantham and others have remarked upon the disappearance, from time to time, of spirochaetes from infected stools, but whether this disappearance is total or only apparent is unknown, owing to our present inability to distinguish the coccoid body or granule stage from surrounding faecal débris. Daily variation in the



intensity of the infection has also been noted, and in this investigation was occasionally marked enough to attract attention. An attempt was therefore made to determine whether such increases in the number of spirochaetes present were periodic and also to obtain information relating to the duration or persistence of the maximum infections and the average length of time elapsing between such infections. With these objects in view, eight positive cases, which could be obtained frequently, were selected and examined as often as possible during one month. At the commencement of this investigation six of these cases were scantily infected and two were 'latent positives,' but when previously examined all had shown spirochaetes, two in fairly large numbers. Six of the patients also were being treated for amoebic dysentery, and all were infected with one or more species of Protozoa. Unfortunately no definite conclusions could be deduced from the results, as throughout the whole period none of the infections increased to any appreciable extent, and one remained continuously latent.

Spirochaetal infections were, as previously indicated, frequently found mixed with single or multiple Protozoal infections of the alimentary tract. From an analysis of the records kept, however, there would appear to be no correlation between the presence of these organisms and the occurrence of any of the commoner Protozoa in the stools. Of the 554 patients admitted into hospital for dysentery, and examined for spirochaetes, 51 were infected with *Entamoeba histolytica*, Schaudinn, 123 with *Entamoeba coli*, (Lösch), and 116 with *Giardia (Lambliia) intestinalis*, (Lambl). These infections, in regard to their relations with spirochaetes, were distributed as follows:—

	Cases	Spirochaetes present	Spirochaetes absent
<i>E. histolytica</i> ... ..	51	23	28
<i>E. coli</i> ... ..	123	67	56
<i>G. intestinalis</i> ... ..	116	57	59

Thus 45 per cent. of the cases infected with *E. histolytica*, 54 per cent. of the *E. coli* infections and 49 per cent. of the *G. intestinalis* infections are positive to spirochaetes. Among the non-dysenteric cases there were four infections of *G. intestinalis* and seventeen of *E. coli*; one of the former and twelve of the latter were mixed with spirochaetes. Among these patients, therefore, no less than 70 per cent. of the *E. coli* infections were positive to spirochaetes, but the figures available are unfortunately too small for any deductions to be drawn.

In conclusion, a few remarks may perhaps be made regarding the length and agglomeration of spirochaetes as observed while the examinations were in progress. *S. eurygyrata* was stated by Werner to vary in length from  $4.6\mu$  to  $7.3\mu$ ; other authors writing on faecal spirochaetes have further separated these extremes, and Fantham has recently given from  $3\mu$  to  $15\mu$  as the variation encountered. Upwards of fifty individuals were selected at hazard and carefully measured; the range in size noted was from  $2.8\mu$  to  $10.8\mu$ , and the average length from  $4\mu$  to  $7\mu$ .

*S. eurygyrata*, like the blood spirochaetes, is said to commonly occur in masses and tangles, and probably this is so in heavy infections; comparatively few such masses were seen during this investigation, however, and then only when the spirochaetes were present in large numbers.

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